Video
FULL DETAILS AND TRANSCRIPT

Demonstrating Thermal Layering

Starr Elementary School, Michigan • March 2008

Topic: How to Organize Your Teaching
Practice: Abstract-Concrete Connections

Highlights

- Science teacher, Tasia Stamos, uses hands-on lab experiments and demonstrations to help her elementary students understand abstract concepts in a science unit on the hydrosphere.
- Prior to this demonstration, students complete a lab that helps them see what happens when liquids of different densities are combined.
- In the thermal layering demonstration, the teacher models the layers of a lake in an aquarium, and uses dyed water to illustrate how temperature affects density.
- After using the model to help students visualize what happens to warm and cold water in a lake, she draws a diagram to illustrate the abstract concept of thermal layers.
- The teacher will also extend the lesson to account for the lake in different seasons and will create a model of a winter lake.

About the Site

Starr Elementary School
Plainwell, MI

Demographics
95.7% White
2.7% African American
.9% Hispanic
.5% Asian
.2% Native American
37% Economically Disadvantaged

Plainwell Community Schools began district-wide curricular initiatives in 2005 focused on improving the way teachers organize and deliver instruction, including the use of non-linguistic representations of abstract concepts across the subject areas. At Starr Elementary, teachers incorporated this particular focus by:

- Using non-linguistic representations of abstract concepts in vocabulary instruction
- Incorporating hands-on science labs and demonstrations to help students makes concrete connections to abstract concepts
- Adopting new social studies curriculum aligned to the middle school curriculum program that embedded research-based instructional strategies
- Coordinating professional development and model lessons through the use of a lead teacher to implement instructional strategies throughout the school.

Full Transcript

Teacher: Not too long ago, we did this experiment that had to do with density, okay. Now, we added a liquid to water, and what happened when that liquid was more dense than the water, can anybody tell me over here?

Student: It floated to the bottom.

Teacher: It floated to the bottom or it --?

Student: Sank.

Teacher: It sank to the bottom, that's right. When things are more dense, they kind of are heavier and they go down, okay. What happens if they are less dense, Brandy?

Student: They float.

Teacher: They float on top, don't they? They are kind of on the surface. But what happens if something has the same density of water, Danielle?

Student: They kind of mix together with the water.

Teacher: They kind of mix together; we don't see any difference to it. There is nothing floating on top. There is nothing on the bottom of that, right? Okay. So, we are going to investigate the concept of thermal layering, and to understand that, you have to remember the information that we learned in our science experiment that dealt with density.

Teacher: We want you to pretend that this is a lake here in Michigan, in the—we are going to pretend it's a lake in the summertime. How many of you have ever been swimming in a lake in Michigan? Alright, okay. What does it feel like when you first jump in the water, Cassidy?

Student: Like, when you go further out into the lake, the water will get colder because it gets deeper.

Teacher: The deeper the water is, the colder it is, right? So, where is your warmer water at in the lake?

Student: Near the shore.

Teacher: Near the shore, which is usually the upper layers, right, the top of the water. If warm water is less dense than hot water, if I add cold water to our lake, where is it going to be, Noah?

Student: In the bottom.

Teacher: It will be in the bottom, okay. Well, I want you to notice I have a container here, and I have blue food coloring in here, and this is going to symbolize the cold water that we are going to add to our Michigan lake. I am going to lay this into the lake and I want you to pay attention where this cold, blue water settles in the lake. Just watch this water for a minute. What do you notice that this cold water is doing in our lake? What do you notice that it's doing? What do you think, Joanna?

Student: It's kind of clouding up.

Teacher: It's clouding up. And where is it staying for the most part? Where is our bluest water, the most blue water? Where do you think it is? Luke?

Student: At the bottom.

Teacher: It's at the bottom of the lake, so our coldest water, the bluest water in our lake is staying down here at the bottom, isn't it? Okay, alright. Now, if I were to add hot water to our lake, where do you think it would be, Tori?

Student: It would probably go, float up to the top.

Teacher: Okay, very good. It would stay at the top or float to the top, now, wouldn't it? Now, let's think about this. When we have lakes here in Michigan, do we go around adding hot water to them? No. How do

those upper layers get warm like that? What causes them to be warm like that, Avery?

Student: The sun.

Teacher: The sun. The sun is what is responsible for actually heating that upper layer, isn't it? Okay. So, let's take some hot water to our lake. We are going to cover it up and do something very similar to what I just did with our cold water, but I am going to wear gloves because this jar is very, very hot. So, I want you to watch this and I am going to do this as gently as I can, so I don't disrupt my layer. Now, you see, our bluest layer is still at the very bottom, right? Bluest water is at the bottom. Let's just gently lay this in here. Now, watch carefully what happens. Cassidy, what do you notice?

Student: The red of the liquid is staying at top, so like the warmer water is covering up mostly, not like the bottom because the bottom is supposed to be more colder than the warm water.

Teacher: Okay. Now, we are thinking about a summer lake in Michigan, okay. We are talking about a summer lake in Michigan. So let's picture a side cut of this lake. Okay. Here is our lake. And you talked about the three layers, is that right? Okay. Now, let's think about, our warmest layer is going to be up here. Fifteen degree Celsius is about what this middle layer will be here in the summer in a lake. Okay. So, anybody want to take a guess about what it might be here, because 15 is about, if it were three to one, maybe this would be about 45 degrees. We are not going to swim in the water that's 45 degrees. What do you think it might be, Noah?

Student: 20 degrees.

Teacher: Actually, you are really, really close. It would probably be about 25 degrees Celsius, okay? And then, this bottom layer down here would be about six degrees Celsius. And this is just on an average small lake here in Michigan, okay? Now, we have our warmest layer on top, our coldest layer on the bottom. Where in our summer lake are we going to find our most dense layer? Let's see, what can we come up with? Avery, what can you come up with?

Student: It's going to be at the bottom.

Teacher: It's going to be at the bottom, and this is going to be our coldest water or our warmest water?

Student: Coldest.

Teacher: Coldest water. So where is the least dense layer? What do you think, Sarah?

Student: The top.

Teacher: The top, very good. And is this our coldest layer or our warmest layer?

Student: Our warmest.

Teacher: Our warmest layer, so in a summer lake in Michigan, the warmest water is the least dense.